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Optimising field screening for cassava brown streak disease resistance: enhancing efficiency and reducing costs

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Abstract

Cassava brown streak disease (CBSD) remains the most severe threat to cassava production in the Great Lakes region and Southern Africa. Screening for virus resistance by subjecting cassava to high virus pressure in the epidemic zone (hotspots) is a common but lengthy process because of unpredictable and erratic virus infections requiring multiple seasons for disease evaluation. This study investigated the feasibility of graft-infections to provide a highly controlled infection process that is robust and reproducible to select and eliminate susceptible cassava at the early stages and to predict the resistance of adapted and economically valuable varieties. To achieve this, a collection of cassava germplasm from the Democratic Republic of Congo and a different set of breeding trials comprising two seed nurseries and one preliminary yield trial were established. The cassava varieties OBAMA and NAROCASS 1 infected with CBSD were planted one month after establishment of the main trials in a 50 m² plot to serve as the source of the infection and to provide scions to graft approximately 1 ha. Grafted plants were inspected for virus symptoms and additionally tested by RT-qPCR for sensitive detection of the viruses. The incidence and severity of CBSD and cassava mosaic disease (CMD) symptoms were scored at different stages of plant growth and fresh root yield determined at harvesting. The results from the field experiments proved that graft-infection with infected plants showed rapid symptom development in susceptible cassava plants allowing instant exclusion of those lines from the next breeding cycle. High heritability, with values ranging from 0.63 to 0.97, was further recorded for leaf and root symptoms, respectively. Indeed, only a few cassava progenies were selected while clones DSC260 and two species of *Manihot glaziovii* (Glaziovii20210005 and Glaziovii20210006) showed resistance to CBSD. Taken together, grafting scions from infected cassava is a highly efficient and cost-effective method to infect cassava with CBSD even under rugged field conditions. It replaces an erratic infection process with a controlled method to ensure precise screening and selection for virus resistance. The clones identified as resistant could serve as elite donors for introgression, facilitating the transfer of resistance to CBSD.

Keywords: Breeding, field screening, grafting, heritability, hotspot, RT-qPCR

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